

CLAIMS

What is claimed is:

1. An automatic belt tension apparatus for an image forming device including at least one belt having an image adhesion face to attach and transfer a developer image at a first surface thereof, and a driving unit supporting the belt and selectively driving the belt to rotate, the automatic belt tension apparatus comprising:
 - a tension applying part to apply a predetermined tension to the belt, installed with respect to the belt;
 - a tension releasing part operating the tension applying part to not apply the predetermined tension to the belt, installed with respect to the tension applying part; and
 - a tension actuating part, to actuate the tension applying part to apply the predetermined tension to the belt against the tension releasing part, only during operation of the driving unit, installed with respect to the driving unit and the tension releasing part.
2. The automatic belt tension apparatus according to claim 1, wherein the tension applying part comprises:
 - a swing shaft having ends supported at a frame;
 - a tension roller selectively coming in contact with a second surface of the belt; and
 - a swing arm, fixed on the swing shaft, and rotatably supporting the tension roller.
3. The automatic belt tension apparatus according to claim 2, wherein the tension applying part further comprises a first elastic member exerting a first elastic rotating force on the swing arm, to swing the tension roller in a first direction of contacting with the second surface of the transfer belt, installed with respect to the swing shaft, the frame, and the swing arm.
4. The automatic belt tension apparatus according to claim 3, wherein the first elastic member comprises a first tension spring, installed with respect to the swing shaft, and having ends supported at the frame and the swing arm, respectively.

5. The automatic belt tension apparatus according to claim 3, wherein the tension releasing part comprises a second elastic member exerting a second elastic rotating force on the swing arm, to swing the tension roller in a second direction, opposite the first direction, installed with respect to the frame and the swing arm.

6. The automatic belt tension apparatus according to claim 5, wherein the second elastic member comprises a second tension spring, installed with respect to the swing arm, and having ends supported at the frame and the swing arm, respectively.

7. The automatic belt tension apparatus according to claim 6, wherein the second elastic rotating force of the second tension spring is greater than the first elastic rotating force of the first tension spring, so that the tension roller swings in the second direction, and thereby is biased to not apply the predetermined tension to the belt.

8. The automatic belt tension apparatus according to claim 2, wherein the tension actuating part comprises:

- a tension gear installed on the driving unit;
- a power transmitting gear train comprising a plurality of power transmitting gears connected with the tension gear; and
- a tension clutch installed on the swing shaft and transmitting a driving force transmitted to the power transmitting gear train from the tension gear, to the swing shaft only when the driving force is in a range of a predetermined load torque.

9. The automatic belt tension apparatus according to claim 8, wherein the tension clutch comprises:

- a clutch gear, rotatably installed on the swing shaft to engage with the power transmitting gear train, and having a first clutch boss extended in an axial direction;
- a bushing having a second clutch boss fixed on the swing shaft; and
- a clutch spring coiled on outer circumferential surfaces of the first clutch boss of the clutch gear and the second clutch boss of the bushing, and when the driving force is transmitted from the power transmitting gear train to the clutch gear, transmitting the driving force to the bushing fixed on the swing shaft only when a driving load of the clutch gear is in the range of the predetermined load torque.

10. The automatic belt tension apparatus according to claim 9, wherein the range of the predetermined load torque of the clutch gear is set such that the tension roller, fixed on the swing shaft through the swing arm, applies the predetermined tension to the belt against a second elastic member of the tension releasing part.

11. The automatic belt tension apparatus according to claim 1, wherein the belt comprises a transfer belt, to receive a developer image formed on at least one photosensitive drum at the image adhesion face thereof, and to transfer the developer image onto a recording medium.

12. The automatic belt tension apparatus according to claim 1, wherein the belt comprises an intermediate transfer belt, to receive a developer image formed on at least one photosensitive drum at the image adhesion face thereof, and to transfer the developer image onto a transfer roller, to transfer the developer image onto a recording medium.

13. The automatic belt tension apparatus according to claim 1, wherein the belt comprises a photosensitive belt to form a toner developer image at the image adhesion face thereof.

14. An automatic belt tension apparatus of an image forming device including a frame, a belt, and a driving unit selectively driving the belt, the automatic belt tension apparatus comprising:

- a tension applying part to selectively apply tension to the belt;
- first and second elastic members oppositely biasing the tension applying part to contact and separate from the belt, respectively; and
- a tension actuating part, selectively transmitting a driving force from the driving unit to the tension applying part to apply a predetermined tension to the belt.

15. The automatic belt tension apparatus according to claim 14, wherein the tension applying part comprises:

- a swing arm, rotatably connected to the frame;

a tension roller, rotatably positioned on the swing arm to selectively apply tension to the belt,

wherein the first and second elastic members bias the swing arm.

16. The automatic belt tension apparatus according to claim 15, wherein the tension applying part further comprises:

a swing shaft rotatably connected to the frame,

wherein the swing arm is connected to the swing shaft.

17. The automatic belt tension apparatus according to claim 15, wherein:
the first elastic member comprises a first tension spring having ends respectively supported at the frame and the swing arm; and

the second elastic member comprises a second tension spring having ends respectively supported at the frame and the swing arm.

18. The automatic belt tension apparatus according to claim 14, wherein the bias of the second elastic member is greater than the bias of the first elastic member.

19. The automatic belt tension apparatus according to claim 14, wherein when the driving part is not driving the belt, the second elastic member overcomes the bias of the first elastic member to separate the tension applying part from the belt.

20. The automatic belt tension apparatus according to claim 14, wherein the tension actuating part transmits the driving force from the driving unit to the tension applying part when the driving force is within a predetermined range.

21. The automatic belt tension apparatus according to claim 16, wherein the tension actuating part comprises:

a tension gear installed on the driving unit transmitting the driving force; and

a tension clutch installed on the swing shaft and transmitting the driving force when the driving force is within a predetermined range.

22. The automatic belt tension apparatus according to claim 21, wherein the tension actuating part further comprises:

a power transmitting gear train, having at least one power transmitting gear, and transmitting the driving force from the tension gear to the tension clutch.

23. The automatic belt tension apparatus according to claim 21, wherein the tension clutch comprises:

a clutch gear, rotatably installed on the swing shaft, having a first clutch boss, and receiving the driving force;

a bushing fixed on the swing shaft and having a second clutch boss; and

an elastic clutch member transmitting the driving force from the first clutch boss to the second clutch boss when the driving force is within the predetermined range.

24. The automatic belt tension apparatus according to claim 23, wherein:
the elastic clutch member is a clutch spring coiled on outer circumferential surfaces of the first clutch boss and the second clutch boss;

the clutch gear comprises a first support;

a first end of the clutch spring is slipably supported on the first support such that the clutch spring only transmits the driving force to the second clutch boss when the driving force is within the predetermined range.

25. The automatic belt tension apparatus according to claim 24, wherein:
the bushing comprises a second support; and
a second end of the clutch spring is one of slipably supported and fixedly supported on the second support.

26. The automatic belt tension apparatus according to claim 24, wherein:
the first support has one of a circular-shaped concavo-convex groove and a plurality of spaced apart grooves circumferentially positioned adjacent to an inner edge of the outer circumferential surface of the first boss.

27. The automatic belt tension apparatus according to claim 24, wherein the tension clutch further comprises a clutch ring, disposed to enclose the clutch spring.

28. The automatic belt tension apparatus according to claim 14, wherein:
the belt comprises a transfer belt, receiving a developer image formed on at least one photosensitive drum at an image adhesion face thereof, and transferring the developer image onto a recording medium.

29. The automatic belt tension apparatus according to claim 14, wherein:
the belt comprises an intermediate transfer belt, receiving a developer image formed on at least one photosensitive drum at an image adhesion face thereof, and transferring the developer image onto a transfer roller, to transfer the developer image onto a recording medium.

30. The automatic belt tension apparatus according to claim 14, wherein the belt comprises a photosensitive belt to form a toner developer image at the image adhesion face thereof.

31. An automatic belt tension apparatus of an image forming device including a frame, a belt, and a driving unit, the automatic belt tension apparatus comprising:
a swing arm, rotatably connected to the frame;
a tension roller, positioned on the swing arm, and selectively contacting the belt;
a first elastic member biasing the swing arm in a first direction;
a second elastic member biasing the swing arm in a second direction, opposite the first direction; and
a tension actuating part, transmitting a torque load from the driving unit to the swing arm, to overcome the bias of the second elastic member and apply a predetermined tension to the belt, via the tension roller, when the torque load is within a predetermined range.